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MEASURING AND ANALYZING THE PERFORMANCE OF AN ATOMIC FORCE MICROSCOPE-BASED PROFILOMETER*

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Rayleigh-Taylor instabilities during implosions of inertially confined fusion (ICF) capsules affect capsule performance. During acceleration, surface imperfections grow and can, if large enough, lead to an asymmetric implosion or even shell breakup. For this reason, characterizing the topography of target capsules is extremely important. We have developed a profilometer based on an atomic force microscope combined with a precision rotary air bearing. Averaged 1D surface height power spectra obtained with this instrument are converted to 2D mode spectra, which are used as input to LASNEX simulations. Knowledge of the performance limits of the apparatus are essential to gauge the reliability of the data. In addition, the statistical nature of the technique, i.e. characterizing a 2D surface with 1D measurements, must be considered. We will present measurements of the air bearing runout and overall system noise. Using computer simulations of these measurements, we will also discuss the statistics involved in averaging 1D power spectra. Finally, we will show the application of this measurement technique to capsules that have been laser-ablated, resulting in a well-defined surface topography. This special case provides an excellent test for the system, since the expected results are exactly calculable.

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